LETTERS TO THE EDITOR

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Metargon and the Interplanetary Medium.

THE detection of metargon, and the statement that its spectrum, at all events, closely agrees with the Swan-spectrum, seems to possess a very great interest for the physics of our solar system. It gives a new and expected support to the assumption of an interplanetary atmosphere, which, as I shortly hope to show, will enable us to indicate the solution of most problems relating to the comets, and probably, also, to the sun.

This medium, which gives the acetylene-bands together with the cyan-bands, is already known through different observations :—

(1) In the absorption spectrum of the sun.

(2) In the emission spectrum of the highest beams of the corona (Tacchini).

(3) In the spectra of *all* comets, traversing all parts of the interplanetarian space.

(4) In the occluded gases of meteorites.

(5) Now, at last, as a constituent of the atmosphere of the earth.

The last observation completes the foregoing series, so that we can say that this medium now is found everywhere ; as we should expect to find it, if it really forms a common atmosphere to our planetary system. J. R. RYDBERG.

Lund, July 21.

Metargon.

PROF. SCHUSTER in his last communication on "The Spectrum of Metargon" says, "taking the spectroscopic evidence by itself, it points in the direction that the gas under examination is a compound of carbon either with argon or with a so far unknown body."

This observation has reference to the gas obtained by the volatilisation of a "white solid," amounting to about 1 per cent, which separates during the liquefaction of argon, as stated by Prof. Ramsay and Mr. Travers in their Royal Society papers on the "Companions of Argon." "The argon separated is a liquid, but at the same time a considerable quantity of solid was observed to separate partially round the sides of the tube, and partially below the surface of the liquid." Further, "inasmuch as the gas differs very markedly from argon in its spectrum and in its behaviour at low temperatures, it must be regarded as a distinct elementary substance, and we therefore propose for it the name 'metargon' It would appear to hold the position towards argon that nickel does to cobalt, having approximately the same atomic weight yet different properties." Now, a year ago Lord Rayleigh was kind enough to allow me the use of a sample of pure argon for the purposes of liquefaction. The gas, amounting to about 250 cc., was enclosed in a sealed bulb to which was attached a narrow quill tube for easy condensation in liquid air. I have repeatedly liquefied this sample, and have always obtained a perfectly clear fluid argon free from turbidity, opalescence, or any solid matter. In previous papers I have shown that a very small fraction of a per cent of gaseous impurity, which separates as a solid in the presence of a liquid, can be detected in this way. Thus 0·04 per cent. of carbonic acid in dry air gives an opalescent liquid when similarly treated, and the same thing occurs with oxygen containing less than 0·1 per cent. of chlorine. It would, indeed, be strange if anything like 1 per cent. of a gas giving a white solid at the temperature of liquid air could under similar circumstances escape detection if present in Lord Rayleigh's sample of argon. The question, then, is, Where can the metargon of Prof. Ramsay and Mr. Travers be? JAMES DEWAR.

Royal Institution, August 1.

Liquid Hydrogen.

IN a previous letter I said Mr. Hampson's "*attempt to justify going behind my back in his relations with a member of the staff of the Royal Institution is a too transparent subterfuge to require further comment*," and if I had not reason to feel the necessity of the use of cautious language when using your columns, I should have employed even stronger condemnatory terms.

Considering Mr. Hampson was not seeking from the Royal Institution some general scientific information, but experimental help to improve upon methods of research in which I was actually engaged, and to which my assistant must necessarily be privy, his proceedings were utterly indefensible.

Now Mr. Hampson *tries on a further justification* by pointing to the position of the person who introduced him to the "member of the staff." When Mr. Hampson gives the name of the "senior partner," I will be in a position to judge whether that gentleman's acquaintance with me was such as to fairly warrant him in transferring the introduction to the professor.

In the meantime the question remains, Why did Mr. Hampson, like other persons of University standing desirous of special knowledge or help in the possession of the Royal Institution Chemical Department, not address me in a manly way and request an interview? If he could not write, then why did he not call and send up his card? Why this pretended necessity for an introduction from a superior person of "familiar acquaintance" as a preliminary to a "confident hope of gaining" my "attention directly"? Yet this punctilious gentleman suggests in extenuation that he entertained the possibility of a "*chance meeting*" with me here. How considerate of my position! The course of action Mr. Hampson succeeded in carrying out was admirably adapted to create antagonism between the professor and his assistant.

Mr. Hampson now says: "It is strange Prof. Dewar, having himself published his belief that his assistant is capable of being 'got at' by a complete stranger, should in the very next line attach some importance to that gentleman's account of the transaction." This is, in other words, a covert suggestion that my assistant's veracity is not comparable with his own. Had my assistant ever dreamt that what I regard as a far too precipitate kindness to a "complete stranger" would ultimately be used as material to support an attack upon the character of the professor and the credit of this Institution, I do not doubt for a moment he would have acted with more dignified reserve and cautious consideration; in spite of Mr. Hampson's persuasive influence and the tempting allurement of the introduction from the "senior partner of a large chemical firm in London of the highest standing."

Verily no man can serve two masters at any time, far less when both are engaged on the same research. If conduct like this, which Mr. Hampson has the boldness to characterise as "simple and straightforward," is to be tolerated, the inviolate relations between professor and assistant are ruined, and there is, indeed, an end to any combination of science and morals.

Royal Institution, July 31. JAMES DEWAR.

The Medusa of Lake Urumiah.

I HAVE received to-day a telegram from my son, Mr. R. T. Günther, posted this morning at Tauris, in which he states that the "Medusa" reported by travellers to inhabit in immense numbers Lake Urumiah, proves to be a species of *Branchipus*.

Kew, July 27. ALBERT GÜNTHER.

Distillery Pollution.

THE disposal of the effluents from distilleries and other works is a matter of first interest not only to the proprietors of the works, but also to the riparian owners on the banks of streams on which such works are usually situated, and a few remarks on the possibility of avoiding the Law Courts in matters of pollution of rivers may be of interest, especially to the owners of distilleries. In the Spey district of Scotland, for instance, the great increase of distilleries, both in number and in malting capacity, has in recent years so increased the effluent that although any one distillery may not in itself seriously pollute so large a body of water as the Spey, yet their joint effluent is so great, it is alleged, that the pollution is serious, prejudicially affecting fish life, spawning and the taking of the fly by salmon, and rendering the river otherwise unfit for primary uses. Be these allegations true or false, the fact remains that at the present moment interdict hangs over one distillery—the Macallan Glenlivet Distillery—and if no method is found of avoiding the discharge and consequent fungoid growth, &c., there is no saying what may be the issue and ultimate result to what is now a

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very large industry. It is not proposed to discuss the two sides of the question—the maintenance of the industry or the preservation of the purity of such a fine river as the Spey, or other rivers similarly situated—but rather to consider what can be done to meet both sides. Now it may be held as true that there is no operation to which the burnt ale or spent lees of a distillery can practically be subjected to, that will render the effluent innocuous. The effluent may be evaporated or spread over irrigation fields, or treated with chemicals or charcoal, and yet the processes are in one way or another defective; and there appears but one solution, not to pass the effluent into the rivers, but take it away in pipes or barges to the sea. In many cases this is quite impracticable, even by the joint action of a number of distilleries; but in some cases the effluent has successfully been taken miles in pipes and discharged into the sea. As is known from large experience in outfall pipes for sewage and paper works effluents, it requires a carefully designed arrangement, the cost of which can only be determined after a minute survey; and usually the cost turns out to be too great, and then there appears to be one solution by passing the effluent out in the form of a fine spray from the top of a high chimney or iron lattice tower. The natural question at once asked is: But you pollute the air instead of the water, and what the better are you for doing so? In the first place, what is discharged is not a gas which, if of a noxious quality, might hurt by being inhaled. It is not like soot, which might leave a black mark on your face or clothes. The spray, if it fell on your skin or clothes, could do you no harm, or at least infinitesimal harm. It is not a poisonous liquid, as cattle can drink it. If it fell on trees or grass, except in large quantities, which would not be the case, it would not burn them. Pollution of air is not objected to unless it be in great excess; indeed, we all pollute the air to our neighbours' and our own disadvantage. We send out gases and smoke from our chimneys, which find their way to our neighbours' carpets and curtains and clothes, and we put out the foulest of gas—viz. sewer gas—daily and hourly from the ventilating pipes of our modern house drains, and many of our factories, electric light stations, &c., pass out gases which individually one would say would be sufficient to affect a whole city. There are many physical reasons which make the great difference on the harmless nature of air pollution from water pollution, and that is the cubic capacity of the polluted substance.

In the case of air the air stream is measured in cubic miles, whereas the water stream is a matter of cubic feet; again, the water flows in one fixed channel, whereas the wind and air stream is constantly varying; again, water pollution is worst just when it is put into the river, whereas air pollution is spread over a large area and is thoroughly mixed up before it comes down, possibly one mile or two miles from where it issued from the chimney.

Again, it may be said that even supposing the spray be harmless, yet it would be very disagreeable to be subjected to a fine rain or Scotch mist when near the distillery. Let us consider a distillery sending out four gallons per minute. An ordinary noncondensing engine uses 20 lb. of water per H.P. per hour, so that the quantity discharged from the top of the chimney is no more than what is sent out from a steam engine (high pressure) of 120 I.H.P., and we know from experience that this can be discharged without being felt, and in most weathers even becoming invisible 100 feet away. If it were practicable to reduce the effluent to a state of fine division as fine as the globules of the so-called white steam, and emit it from the top of a chimney, the solution of the matter would be found at once. It does not at present either appear practicable to reduce the effluent to such a fine state of division, nor fortunately is it necessary to do so, as experiment shows that ordinary sprayed particles are rapidly evaporated and absorbed. Take a spray such as barbers use, and spray it from a height of 5 feet in a still atmosphere, and measure the quantity evaporated in its descent. It will be found that at least 1/8th has been lost. Do the same at 10 feet, and it will be found that 1/4th is lost. Theory points to very rapid evaporation, as the particles get small as the surface becomes rapidly large in comparison with the cubic capacity of the spheres. Another good example of rapid evaporation and absorption by the air is to use the spray over a piece of glass. In ordinary weather only a very short space of time renders the sheet glass quite dry again. These two experiments, and our experience of the discharge from steam engines pointing to this, that instead of experiencing a mist or fine rain, the particles would be so minute and so widespread that no one might suffer any inconvenience, indeed might be quite unconscious of the fact that the spraying was going on except from seeing the white steam mist issuing from the chimney of the distillery.

Coming now to a more practical view as to what would be necessary to obtain the desired effect, and trials lead to this, that for a discharge of four gallons per minute it would be necessary to have a pump to pump up this small quantity, also an air pump to pump about forty times the volume liquid, a 5-H.P. oil engine with air pump attached, such as is used in lighthouses for supplying the air blast to fog signals, being ample. The necessary length of pipes leading up to the spraying apparatus with a number of nozzles, and above all a high point of discharge, completes the arrangement.

The height of discharge is evidently one essential of success. The height will vary with the amount of the effluent, and whether the works be situated on a moor, near a town, or in a cleft in the hills, or among high trees.

The increase in the velocity of the wind with height is an important factor. In measuring the velocity at 50 feet, 100 feet and 200 feet, we find a great increase with height, so that instead of a point of discharge of 200 feet being only capable of doing twice what a height of 100 feet will do, as one might at first suppose, yet a little consideration will show, as the area is a measure of the degree of dispersion, that it will disperse successfully much more. In fact whereas 100 feet might discharge one gallon, 200 feet might discharge eight gallons per minute. It would appear, therefore, that to attempt to deal with the effluent by spraying at a low level, as has been in some quarters suggested, is simply to court failure. The point of discharge must be high, but "how high" is a matter which at present is unknown; nor, indeed, can it be definitely fixed, as has been pointed out, each individual work requiring special consideration of the circumstances. There is one other point that requires to be considered in connection with the whole matter, and that is compensation for water abstraction. At present distillers use the water, and what is not sent off as whisky is returned to the stream. But in the case of carrying the effluent to the sea, compensation would require to be given to the stream by means of reservoirs, and with the spraying apparatus a complicated question would arise as to how much really found its way back into the water-courses of the particular drainage area. This is largely a legal question, but it is not clear how the spraying process could differ from the discharge into the atmosphere of an ordinary steam engine, and so it would appear that water compensation for the stream was with this system unnecessary.

C. A. STEVENSON.

The Nature and Habits of Pliny's Solpuga.

I HAVE never seen one of the Arachnoids in a hive, but have received them several times from trustworthy bee-keepers who have found them in the hives "killing and eating the bees." Other insects do the same thing, especially Formicids and Mutillids. Of course the latter, with more chitine, are better fitted to resist the attack of the bees than are the soft-bodied Datames. It may be that these Solpulgids have some protective scent that makes their entrance to the dark recesses of the hive safe.

A. J. C.

Claremont, Cal., June 23.

THE VACCINATION BILL.

IN connection with the recent discussion on the vaccination question, nothing strikes the inquiring observer more than the shortness of the collective memory of a people, unless, indeed, it be the fact that people are easily led by any small knot of agitators who will shout loudly enough and asseverate with sufficient force and frequency.

That this is true not only of what may be called the masses, but also of their selected representatives in the House of Commons, is evident from what has recently transpired in that august assembly. The career of the Vaccination Bill has been marked by many stormy passages and by very varying fortunes, and now that it has passed through its first stage, there appear to be few who are even partially satisfied. This is a result

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